

Motion of Particles in a Crimped Toroidal
Magnetic Field

77837
SOV/57-30-3-3/15

or evaluated between the points where $v_{||}$ reduces to zero for "locked" particles.. The line of integration is described using coordinates x and ρ , defined as:

$$r = R; \quad x = r - R, \quad \rho = \sqrt{x^2 + z^2}, \quad x = \rho \cos \varphi$$

on some fixed cross-section $\odot = \text{const}$ (see Fig. 1). Using conservation of modulus of velocity vector and introducing transverse adiabatic invariant $J_{\perp} = v_{\perp}^2/H$, the authors rewrite Eq. (1) in the form:

$$J_{\perp}(\rho, x, J_{\parallel}) = \oint \sqrt{v^2 - J_{\parallel}^2 H} dl. \quad (2)$$

Equation $J_{\parallel}(\rho, x, J_{\perp}) = \text{const.}$ represents the equation of the magnetic surface along which the

Card 3/10

Motion of Particles in a Crimped Toroidal
Magnetic Field

77337
SOV/57-30-3-3/15

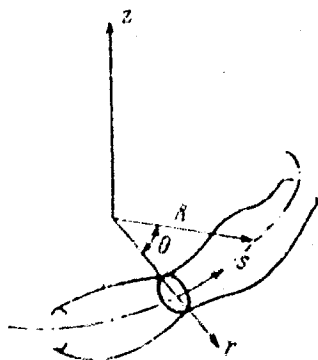


Fig. 1.

Card 4/10

particle is moving. If \odot - constant section is
taken across a maximum (or minimum) of the field or

Motion of Particles in a Crimped Toroidal
Magnetic Field

77837
SOV/57-30-3-3/15

axis $r = R$, displacement of the particle during a period is determined from equations of Kadomtsev

$$\Delta\varphi = \frac{mc}{eH_0} \frac{dJ_1}{d\rho}, \quad \Delta\varphi = -\frac{mc}{eH_0} \frac{dJ_2}{d\rho}, \quad (3)$$

where $H(\rho, \varphi)$ = field strength in section. Particles for which $\Delta\varphi = 0$ the authors call resonant particles. In general, it is difficult to discover conditions that have to be satisfied by the field, which would ensure trajectories defined by equation:

$$J_1(\rho, R, J_1) = \text{const}. \quad (4)$$

correspond to an absolute trap. The authors, therefore, limit themselves to the case when R is finite but sufficiently large. They prove for $R \rightarrow \infty$ trajectories of particles differ by an arbitrarily small

Card 5/10

Motion of Particles in a Crimped Toroidal
Magnetic Field

77837
SOV/57-30-3-3/15

quantity from circle $\rho = \rho_0$, whenever $\xi = x/R$
varies between the limits $(\xi_0 \approx -\rho_0/R) < \xi <$
 $(\xi_0 \approx \rho_0/R)$ by proving the following mathematical
theorem: All points of an arbitrary continuous
segment of curve

$$J(\rho, \xi) = J(\rho_0, \xi_0), \quad (7)$$

containing point (ρ_0, ξ_0) and lying inside strip
 $-a < \xi_0 \leq \xi \leq \xi_0 < a$ are arbitrarily close to
point (ρ_0, ξ_0) if ξ_0 and $\xi_0 \rightarrow 0$. This constitutes
proof that in the region where the longitudinal
invariant holds, crimped toroidal magnetic field
represents an absolute trap for a sufficiently large
R. The authors show next that field with $\partial J / \partial \xi$

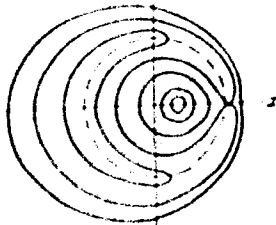
Card 6/10

Motion of Particles in a Crimped Toroidal
Magnetic Field

77837

SOV/77-30-3-3/15

finite and with $\partial J_{||} / \partial \xi \rightarrow \infty$ leads to equation of motion similar in structure. Next they show in the case of $\partial J_{||} / \partial \rho \neq 0$ the displacement of the particle during bending of the field is proportional to $1/R$, while for the resonant case where $\partial J_{||} / \partial \rho = 0$ and with $\partial^2 J_{||} / \partial \rho^2 \neq 0$ it is proportional to $1/R^{1/2}$. In the former case trajectories have then the shape of displaced circles, while in the latter case they have the form of horseshoes as on Fig. 4.



Card 7/10

Fig. 4.

Motion of Particles in a Crimped Toroidal
Magnetic Field

77837
SOV/57-30-3-3/15

Turning their attentions to weakly crimped field, the authors start from a scalar potential of such a field:

$$\phi = H_0 s - \frac{h}{4} \sin 2s / s_0(\tau\psi),$$

where

$$s = R\tau, \rho^2 = x^2 + z^2, x = r - R.$$

and potential is valid for $R \gg L$ and $h \ll H_0$. They discuss in detail trajectories of "locked in" and "flying through" particles. To compare these results obtained from $J_{||} = \text{const}$ equation, the authors finally investigate motion of particles from the standpoint of drift equations. They show modulus of departure of solutions for the curved case from

Card 8/10

Motion of Particles in a Crimped Toroidal
Magnetic Field

77237
SOV 57-30-3-3/15

solutions for R $\rightarrow \infty$ case is bounded except in the case of resonances. They compute drift angle $\Delta\varphi_T$ per period for the straight case, assuming it to be (in the approximation used) the same as that of the curved field. To estimate validity of the longitudinal invariant approach, they compare drift equations with equations (3). They find ratio of accuracy of drift equations and equations (3) by Kadomtsev are of the order of $\nu T/L$. Except for a small group of very slow particles with large T, whose velocity range is exponentially small:

$$\frac{\Delta\nu}{\nu} \sim \frac{1}{T} e^{-\frac{\nu}{T}}$$

the majority of particles have $\nu T/L \sim 1$, and discrepancy between the theories is small. The authors also conclude only resonant particles with $\Delta\varphi_T = 2m\pi$

Card 9/10

Motion of Particles in a Crimped Toroidal
Magnetic Field

77837
SOV/57-30-3-3/15

can escape from the trap. They note since equation $J_{||} = \text{const}$ is valid during a longer period of time than drift equations, one can expect $J_{||}$ to be conserved longer than Kadomtsev Equations (3) from which it is deduced. Academicians M. A. Leontovich and L. A. Artsimovich appraised and discussed the problem. There are 5 figures; and 7 references, 4 Soviet, 3 U.S. The U.S. references are: L. Spitzer. The Stellarator Program. Report at the Geneva Conference, 1958. N. Wentzel. Astr. J., 126, Nr 3, 559, 1957; M. Rosenbluth, C. Longmire. Ann. of Phys., 1, 120, 1957.

ASSOCIATION: None given.

SUBMITTED: May 26, 1959

Card 10, 10

9.3190, 24.2120, 15.7500

7783c
SOV/57-36-3-4/15

AUTHORS: Morozov, A. I., Solov'yev, L. S.

TITLE: Motion of Particles in a Screwed Toroidal Magnetic Field

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1960, Vol 30, Nr 3, pp 271-282 (USSR)

ABSTRACT: The authors generalized the longitudinal invariant of the screwed field bent into a torus and used it to investigate the motion of particles in such a field. They started by a thorough exposition of the structure of the screwed field previously discussed in part by Spitzer, Johnson, et al. (see refs). The field with the screwed symmetry $H = H(r, \varphi - \alpha z)$ can be represented by means of a scalar potential:

$$\psi = H_0 z + \frac{1}{i} \sum_{n=1}^{\infty} h_n f_n(r) \sin n\theta, \quad \theta = \varphi - \alpha z, \quad (1)$$

Card 1/7

Motion of Particles in a Screwed Toroidal
Magnetic Field

77838
SOV/57-30-3-4/15

where $r_n(r) = I_n(\alpha nr)$, $\alpha = 2\pi/L$; L = pitch of
the screw; or, by means of a vector potential:

$$A_z = H_0 \frac{r^2}{2}; A_r = r \sum_{n=1}^{\infty} h_n f_n(r) \sin n\theta, A_\theta = -\frac{r}{\alpha} \sum_{n=1}^{\infty} \frac{h_n}{n} f'_n(r) \cos n\theta. \quad (2)$$

Using the averaging method of Bogolyubov (N. N. Bogolyubov, Yu. A. Metropol'skiy, Asimptoticheskiye metody v teorii nelineynykh kolebaniy (Asymptotic Methods in the Theory of Nonlinear Oscillations) GITTL, M., 1955), they obtain equations for the magnetic field lines and discuss also the exact solutions for the field lines. These lines may be divided into two classes separated by a surface "separatrix": (1) collective lines remaining inside a certain cylinder; (2) isolated lines leaving that region. The section of the separating surface with phase $\varphi = \text{const}$ has the form of a rosette. Figure 2 shows such a rosette "separatrix" for $n = 3$. In space the separatrix represents an n -gonal

Card 2/7

Motion of Particles in a Screwed Toroidal
Magnetic Field

77050
30V, 37-39-3-4/15

screwed surface with a pitch L . In addition to obtaining the equation of the separatrix, the authors derive also the general expression for the phase shift:

$$\Delta\varphi = \frac{\pi h^2}{2^2 H_0^2 n} \left\{ \frac{1}{r} \frac{d}{dr} \right\} \left[f^2 + \frac{h^2}{4^2 H_0^2 n^2} \frac{1}{r} \frac{d}{dr} (r f, f^2) \right].$$

exact to terms in h^2/n^2 . Next they derive the expression for the longitudinal invariant in the case of "locked in" particles:

$$J_{||}(r_0, \tau_0) = \text{const.} \quad (12)$$

and show that in the case of "flying through" particles, the pertinent equation is given by:

$$W = Q - J_{||} = \frac{2\pi e}{mc} \int H \sqrt{\frac{g}{\pi \omega}} \omega(r) dr - J_{||} = \text{const.} \quad (19)$$

where $\omega = \bar{a} \lambda / 2\pi$; \bar{a} is some initial value of a , and $\lambda = L/n$ is pitch of the magnetic field line of a particular harmonic. The authors extend automatically to the present case the proof for the absolute character of the trap (derived in the preceding article

Card 3/7

Motion of Particles in a Screwed Toroidal
Magnetic Field

77838
SOV/57-30-3-4/15

(A. I. Morozov, L. S. Solov'yev, ZhTF, XXX, 261, 1960)
for the case of a corrugated field) by conserving
either $J_{||}$ or W . A special feature of the screwed
field motion is the absence of "locked-in" particles
from the axis of the field. This may be explained
by the fact that the alternating component vanishes
as one approaches the axis. The authors also note that
in the present field there exists a resonance only
for particles moving against the field ($H\bar{v} < 0$).
Again, as in the corrugated field case, excluding
the small number of particles for which $v T/L \gg 1$,
one can claim that in the limits of the longitudinal
invariant the screwed toroidal magnetic field rep-
resents an absolute trap in the region inside the
separatrix. The authors next investigate the motion
of particles in fields with a strong longitudinal
component bent into a torus of a sufficiently large
 R , so that one can neglect quantities of the order
of $1/R^2$.

Card 4/7

1. *Journal of Plasma Physics*, 1977, 17, 3, 307-317

17700
SOV 87-24-3-4715

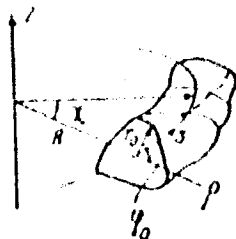


Fig. 4.

They limit themselves also to fields whose scalar potential contains only the first harmonic. They compute $J_{||}$ for the "locked-in" particles and show that in the neighborhood of the resonance, the particle does not complete the path around the axis of the torus but follows some horseshoe-like curve. The "flying-through" particles are discussed using the W invariant, and the authors in particular evaluate the amount by which the circular motion in the meridional planes of the torus is displaced from the axis $r = 0$. Finally, the authors discuss the

Card 1/7

Motion of Particles in a Screwed Toroidal
Magnetic Field

77838
SOV/57-30-3-4/15

and gave advice. There are 4 figures; and 6 references,
4 Soviet, 2 U.S. The U.S. references are: L. Spitzer,
The Stellarator Program, Report at Geneva Conference,
1958; J. Johnson et al., Some Stable Hydromagnetic
Equilibria, Report at Geneva Conference, 1958.

SUBMITTED: May 26, 1959

Card 7/7

84451

S/057/60/030/009/017/021
B019/B054

26.2331

AUTHORS: Morozov, A. I. and Solov'yev, L. S.

TITLE: The Acceleration of Plasma in the Coaxial

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1960, Vol. 30, No. 9,
pp. 1104-1108

TEXT: In the first part of the present paper, the authors investigate the equilibrium of an accelerated plasma, assuming acceleration to occur in a coaxial device with an azimuthal magnetic field. The equation of

equilibrium $-\nabla(p + H^2/8\pi) + (1/4\pi)(\vec{H}\nabla)\vec{H} + \rho\vec{a} = 0$ (1) is written down, and on the assumption of isothermal conditions the equation

$2c_T^2 \partial h / \partial z + a \partial / r \partial r (r^2 h) = 0$ (5) is obtained from (1) in cylindrical coordinates. Here, $h = H^2/8\pi$, and c_T is the sonic velocity in the plasma. ✓

(5) has the general solution $h = (\Phi/r^2)(z - \frac{1}{a} 2c_T^2 \ln r)$ (6). Further,

Card 1/3

84451

The Acceleration of Plasma in the Coaxial

S/057/60/030/009/017/021
B019/B054

qualitative consideration. They obtain approximate expressions for the layer on the walls of the coaxial device, and find that this layer has small thickness if the particle concentration in the plasma cluster is higher than $10^{18} - 10^{19}$. Finally, the authors thank Academician L. A. Artsimovich for his interest and advice. There are 4 figures and 3 Soviet references.

SUBMITTED: April 8, 1960

Card 3/3

3.2600 (2205)
10.8000
24.2120 (1049, 1482, 1502) / 37 /
26.1410

21538
S/057/61/031/004/004/018
B125/B205

AUTHOR: Solov'yev, L. S.
TITLE: Magnetohydrodynamic surface waves
PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 4, 1961, 407-418

TEXT: The present paper deals with non-linear surface waves of an ideally conducting plasma in the presence of an external magnetic field. The relation $\text{div } \mathbf{v} = 0$, $\text{curl } \mathbf{v} = 0$ holds for both the potential flow of an incompressible liquid and the external magnetic field. The internal magnetic field is considered to be non-existent. Substitution of the functions Ψ and Ψ_0

gives $H_x = -\frac{\partial \Psi}{\partial y}$, $H_y = \frac{\partial \Psi}{\partial x}$, $v_x = -\frac{\partial \Psi_0}{\partial y}$, $v_y = \frac{\partial \Psi_0}{\partial x}$ (1). Ψ and Ψ_0 satisfy the Laplace equation $\Delta \Psi = 0$, $\Delta \Psi_0 = 0$ (2). If the magnetic field strength is measured in units of the Alfvén velocity $H = B/\sqrt{4\pi\rho}$, the following boundary conditions are valid on the surface of the plasma: $(\nabla \Psi)^2 + (\nabla \Psi_0)^2 = \text{const}$ (3) and $\Psi = \text{const}$ and $\Psi_0 = \text{const}$ (4). The first section is devoted to separate

Card 1/11

21538

S/057/61/031/004/004/018
B125/B205

Magnetohydrodynamic surface waves

and after introducing the dimensionless variables

$\frac{y}{d_2} = z, \frac{x}{d_2} = \xi, \frac{d_1}{d_2} = \alpha, \frac{v_0}{H_0} = \beta$ it follows that

$$\left(\frac{dz}{dt}\right)^2 = \frac{4k^2 z_1}{s_m} z^2 \frac{z - s_m}{z - z_1}, \quad (10) \quad \text{with}$$

$$k^2 = \frac{3s_m}{4\alpha} \frac{1}{\alpha - 1 + s_m}, \quad z_1 = \frac{s^3 - s + (s^2 + s)s_m}{s^3 + 1 + (s^2 - 1)s_m}, \quad \beta^2 = \frac{s + s_m}{1 - s_m}. \quad (11) \quad (11).$$

For $\alpha = 1 (d_1 = d_2)$ one has $z_1 = z_m$, and there exists no solution in the form of a separate wave. Then, the integral of (10) reads

$$-\arctan \left[\frac{z_1(z - z_m)}{z_m(z - z_1)} \right] + \left[\frac{z_m}{z_1} \arctan \frac{z - z_m}{z - z_1} \right] = k \xi \quad (12). \quad \text{For } |z_m| \ll |z_1| \text{ the solu-}$$

tion has the form of a single wave on the surface of the heavy fluid. Both running convexities (at $\alpha > 1$) and running concavities (at $\alpha < 1$) may exist in
Card 3/11

21538

S/057/61/031/004/004/018
B125/B205

Magnetohydrodynamic surface waves

the present case. For reasons of symmetry, there is no solution for $d_1 = d_2$. When $d_2 > d_1$, the convexity changes into a concavity. Next, the author studies periodic waves under the same geometrical conditions that are present in the case of separate waves (of. figure). Here, the steady flow of an incompressible fluid in an external magnetic field is considered. The stream functions satisfying the Laplace equation are set up as series:

$$\left. \begin{aligned} \psi_0 &= v_0 y + (v_1 e^y + w_1 e^{-y}) \sin x + (v_2 e^{2y} + w_2 e^{-2y}) \cos 2x + \dots \\ \psi &= H_0 y + (H_1 e^y + h_1 e^{-y}) \sin x + (H_2 e^{2y} + h_2 e^{-2y}) \cos 2x + \dots \end{aligned} \right\} \quad (14) \quad ||$$

By comparing coefficients one finds

$$\begin{aligned} \frac{v_0}{H_0} - \frac{v_1}{H_1} &= \frac{3}{8} \left(\frac{v_1^2}{H_0^2} - \frac{v_0^2}{v_0^2} \right) + \frac{1}{4} \left(\frac{v_1 b_1^2}{H_0^2} - \frac{v_0 b_{10}^2}{v_0^2} \right) + \\ &+ \left(\frac{v_1 b_2}{H_0^2} - \frac{v_0 b_{20}}{v_0^2} \right) + \frac{1}{2} \left(\frac{v_1 b_1}{H_0^2} - \frac{v_0 b_{10}}{v_0^2} \right), \end{aligned} \quad (15),$$

Card 4/ 11

21538

S/057/61/031/004/004/010
B125/B205

Magnetohydrodynamic surface waves

$$-v_0 b_{10} - H_0 b_1 = -\frac{3}{8} \left(\frac{a_1^2 b_1}{H_0} + \frac{a_{10}^2 b_{10}}{v_0} \right) + \frac{3}{2} (a_1 a_2 + a_{10} a_2)_0 - (b_1 b_2 + b_{10} b_{20}), \quad (16),$$

$$\frac{a_{10} b_{10}}{2v_0^2} + \frac{a_{10}}{v_0} = \frac{a_1 b_1}{2H_0^2} + \frac{a_1}{H_0} - \frac{3a_{10}^2}{4} + \frac{b_{10}^2}{4} - 2v_0 b_{10} = \frac{3a_1^2}{4} - \frac{b_1^2}{4} + 2H_0 b_1, \quad (16)$$

where a_n, a_{n0}, b_n, b_{n0} indicate the quantities $v_n + w_n = a_{n0}$, $v_n - w_n = b_{n0}$, $H_n + h_n = a_n$, $H_n - h_n = b_n$, respectively. From the boundary conditions $H_y|_{y=d_2} = 0$, $v_y|_{y=-d_1} = 0$ it follows that $w_n = -v_n e^{-2nd_1}$, $h_n = -H_n e^{2nd_2}$, $a_{n0} = b_{n0} \tanh d_1$, $a_n = -b_n \tanh d_2$. From the equations of first approximation one obtains the following relation for $\tanh d_1 = t_1$:

$$v_0 = \frac{B_0}{\sqrt{4\pi\rho}} \sqrt{\frac{t_1}{t_2} \left(1 + \frac{A^2 (t_1 + t_2) [(3 - t_1 t_2)^2 + 4(t_1 - t_2)^2]}{t_1^2 t_2^2 (t_1 - t_2)} \right)}. \quad (17);$$

Card 5/11

21538

S/057/61/031/004/004/018
B125/B205

Magnetohydrodynamic surface waves

present paper is devoted to waves on the surface of a plasma cylinder rotating about its axis. For the purpose of investigating such waves, the authors apply the general equations for the steady helical flow of an incompressible, ideally conducting fluid in a magnetic field:

$$\Delta^* \xi + \frac{a a'}{\beta} + \beta b b' - \frac{2 a a'}{\beta^2} + u' = 0, \quad (21)$$

$$s a = I_0 \psi'_0 - I \psi', \quad s b = \frac{1}{\beta} (I \psi'_0 - I_0 \psi'), \quad (22)$$

$$p + \frac{v^2}{2} = -s(u + \beta b^2), \quad \psi_0^2 - \psi'^2 = s, \quad (23)$$

$$r v_r = \frac{\partial \psi_0}{\partial \theta}, \quad v_\theta - a r v_r = -\frac{\partial \psi_0}{\partial r}, \quad v_r + a r v_\theta = I_0, \quad (24)$$

$$r H_r = \frac{\partial \psi}{\partial \theta}, \quad H_\theta - a r H_r = -\frac{\partial \psi}{\partial r}, \quad H_r + a r H_\theta = I, \quad (25)$$

The "internal" and the "external" problem can be exactly calculated, and approximations are used only if these solutions are "fused" at the "seams"

Card 7/11

21538

S/057/61/031/004/004/018

B125/B205

Magnetohydrodynamic surface waves

between plasma and field. The functions Ψ and Ψ_0 are written as $\Psi = \bar{\Psi} + \tilde{\Psi}$, $\Psi_0 = \bar{\Psi}_0 + \tilde{\Psi}_0$ (26). For the unperturbed state one has $H_2 = H_{2R}$, \bar{V}_{2R} , $\bar{H}_\varphi = H_{\varphi R} \frac{r}{R}$, $\bar{V}_\varphi = V_{\varphi R} \frac{r}{R}$ (27), i.e., a plasma cylinder of radius R , which has a homogeneous longitudinal current and a homogeneous longitudinal magnetic field, will rotate about its axis as a whole. Moreover, the existence of a longitudinal surface current is supposed. The functions $\bar{\Psi}_0$, $\bar{\Psi}$ and I_0 , I for the unperturbed state result from (24) and (25). Here and henceforward, the subscript R is omitted. In the present case, Eq. (21) is linear. For the velocity and the magnetic field strength, the following expression is found in cylindrical coordinates:

$$\begin{aligned} v &= \left\{ \frac{1}{r} \frac{\partial \tilde{\Psi}_0}{\partial \theta}, \frac{v_r}{R} + \frac{1}{\beta} \left(\epsilon r \tilde{\Psi}_0 - \frac{\partial \tilde{\Psi}_0}{\partial r} \right), v_\theta + \frac{1}{\beta} \left(\epsilon \tilde{\Psi}_0 + r \frac{\partial \tilde{\Psi}_0}{\partial r} \right) \right\}, \\ H &= \left\{ \frac{1}{r} \frac{\partial \tilde{\Psi}}{\partial \theta}, \frac{H_r}{R} + \frac{1}{\beta} \left(\epsilon r \tilde{\Psi} - \frac{\partial \tilde{\Psi}}{\partial r} \right), H_\theta + \frac{1}{\beta} \left(\epsilon \tilde{\Psi} + r \frac{\partial \tilde{\Psi}}{\partial r} \right) \right\}. \end{aligned} \quad (34),$$

Card 8/11

21538

S/057/61/031/004/004/018
B125/B205

Magnetohydrodynamic surface waves

and
$$p + \frac{v^2}{2} = \frac{(J_0 v_\varphi - J H_\varphi)}{a R J} \left\{ \phi - \frac{\beta J}{2 a^2} \left(\frac{J_0 H_\varphi - J v_\varphi}{J_0 v_\varphi - J H_\varphi} \right)^2 \right\} + \text{const.} \quad (35) \quad (35)$$

follows from (23). The boundary condition for the equality of pressures reads

$$-\frac{v^2}{2} - \frac{r^2}{2 a R} \frac{(J_0 H_\varphi - J v_\varphi)^2}{J_0 v_\varphi - J H_\varphi} + \frac{H_z^2}{2} = \frac{H_0^2}{2} + \text{const.} \quad (36) \quad (36).$$

When formulating the solution to Eq. (21) as $\tilde{v} = f(r) \sin n\theta$, the expression

$$\frac{1}{r} \frac{d}{dr} \left(\frac{r}{\beta} \frac{df}{dr} \right) + \left(\frac{v^2}{\beta} - \frac{2 r^2}{\beta^2} - \frac{n^2}{r^2} \right) f = 0. \quad (38) \quad (38)$$

is obtained for $f(r)$. The magnetic field outside the plasma column satisfies the equation

$$\Delta^* \tilde{v}_e - \frac{2 \alpha I_0}{\beta^2} = 0 \quad (39).$$

Card 9/11

21538

S/057/61/031/004/004/018
B125/B205

Magnetohydrodynamic surface waves

For $f_e(r)$ one has $\frac{1}{r} \frac{d}{dr} \left(\frac{r}{\beta} \frac{df_e}{dr} \right) - \frac{n^2}{r^2} f_e = 0$ and

$f_e = A_n r I'_n(\alpha n r) + B_n r K'_n(\alpha n r)$ (47), where I_n and K_n are Bessel functions with imaginary argument. The final expression

$$h_1 = \frac{\alpha_1(m-1) + m\epsilon_1}{k(1+\epsilon_1^2)} + \frac{\sqrt{(m-1)(1+\epsilon_1^2)\alpha_1^2 + m[1-(m-1)\alpha_1^2]\epsilon_1^2 - (m-1)(\alpha_1^2 - 2\alpha_1 m\epsilon_1 + m)}}{k(1+\epsilon_1^2)}, \quad (54)$$

with $\epsilon_1 = \frac{H_{ze}}{H_z}$ indicates that the quantity h_1 which is necessary for a stable oscillation, increases owing to the rotation of the column. This may result in an instability. The steady helical flow of an ideally conducting fluid in a magnetic field is calculated in a mathematical appendix. There are 8 Soviet-bloc references.

Card 10/11

24768

S/051/61/031/010/001/015

B111/B112

Magnetic surfaces

If the field is helically symmetric, the magnetic surfaces can be exactly determined in this case. All magnetic surfaces discussed here (rosette, chains and interlinked tubes) are significant for plasma trapping. If the position of a magnetic surface and the distribution of the lines of force on it are known, it will be possible to construct the adjacent surfaces. At a normal distance w from the given surface, fields with translational symmetry ($\vec{H} = \vec{H}(x, y)$), axial symmetry ($\vec{H} = \vec{H}(r, z)$), and helical symmetry ($\vec{H} = \vec{H}(r, \theta)$) are given by $wH_{\parallel} = \text{const}$, $wrH_{\perp} = \text{const}$, and $w\sqrt{1 + \alpha^2 r^2} \cdot H_{\perp} = \text{const}$, respectively, where H_{\perp} is the magnetic-field component on the given surface, which is perpendicular to z , to the φ -lines, and to the helical lines $\theta - \varphi - \alpha z = \text{const}$, respectively. I. M. Gel'fand, M. I. Grayev, and M. A. Leontovich are thanked for discussions. There are 10 figures and 6 references: 4 Soviet and 2 non-Soviet. The two references to English-language publications read as follows: Ref. 3: L. Spitzer, The stellarator program, report at the Second Geneva Conference 1958, Ref. 4: J. I. Johnson et al., Second Geneva Conference 1958.

SUBMITTED: November 2, 1960

Card 3/3

28767
S/057/61/031/010/002/0.5
B111/B117

Magnetic surfaces of a triply twisted ...
 i.e., a perturbation of the form $\psi_{\text{corr}} = \frac{h_0}{\omega} I_0(kr) \sin kxz$ (4) on
 magnetic surfaces at different h_0 and k . Since the total field (1) + (4)
 is not symmetric, magnetic surfaces can only be calculated numerically.
 The dependence of the angle of climb of the lines of force on a certain
 characteristic radius must usually be investigated separately. Computations
 are made for $\psi = z + h_3 I_3(3r) \sin 3(\varphi - z) + h_0 I_0(kr) \sin kz$, $k = 1$
 and $k = 3$, $h_3 = 3$ at different h_0 . The interval in which one line of
 force was considered, was taken as $0 \leq z \leq \pi$ ($K = 25$ and 50 , $L = 100$).
 Integration was performed by the Runge-Kutta method with the steps
 $\frac{2\pi}{40}$, $\frac{2\pi}{80}$, and $\frac{2\pi}{160}$. In particular, the following cases were discussed:
 1) $k = 1$, $h_0 = 0.3$ and 0.6 . The magnetic surfaces approach one another
 with increasing h_0 , and tubes not enclosing the z -axis are formed at
 $h_0 = 0.6$. 2) $k = 3$, $h_0 = 0.05$, $h_0 = 0.1$, and $h_0 = 0.125$. A periodicity
 in z with the period $2\pi/3$ was found in these cases. For $k = 3$, $h_0 = 0.1$
 the magnetic surfaces coincide with those obtained at $k = 1$, $h_0 = 0.6$.
 Card 2/4

20749 ...
3/057/61/031/010/002/015
Magnetic surfaces of a triply twisted ... B111/B112

Inside the fully developed surfaces there occurs a new surface with a three-lobed cross section. This configuration does not rotate but merely vibrates. The magnetic surfaces disappear under the action of strong perturbations, and the points lie on curves with helical cross sections (Fig. 9). The figures indicate the succession of the curve points. There are 10 figures and 5 Soviet references.

SUBMITTED: November 17, 1960

Card 3/4

24705

S/056/61/040/005/003/019
B102/B201

26.2212

24.6750

AUTHORS: Morozov, A. I., Solov'yev, L. S.

TITLE: Kinetic consideration of some equilibrium plasma configurations

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 5, 1961, 1316 - 1324

TEXT: There is a number of plasma systems being of interest in practice, the properties of which cannot be described within the limits of magnetohydrodynamics. Such are, e.g., systems with acute-angled geometry, adiabatic traps with ion injection ("Ogra", "Astron"). Kinetic calculations of equilibrium configurations have been repeatedly performed for special cases. The authors of the present paper offer a kinetic treatment of some concrete one-dimensional plasma configurations. In view of the fact that systems, in which the Larmor radius of both electrons and ions is small compared with the scale of inhomogeneity of the field, can be treated in terms of magnetohydrodynamics, the systems studied here have dimensions of the order of the Larmor radius of electrons or ions. Two limiting cases

Card 1/10

24705

S/056/61/040/005/005/019

3102/B201

Kinetic consideration of some...

may be distinguished here: in one there is a region of transition of the order of the Larmor radius between the plasma without magnetic field and the magnetic field; in the other, the whole region occupied by the plasma is of the order of the Larmor radius ("Ogra", "Astron"). The authors restrict themselves here to one-dimensional problems, where all quantities are functions of only one coordinate (x), and the equilibrium configuration (neglecting collisions) is given by Vlasov's equations

$$v_x \frac{\partial f_e}{\partial x} - \frac{e}{m} \left(E + \frac{1}{c} [vH] \right) \frac{\partial f_e}{\partial v} = 0,$$

(1a, b)

$$v_x \frac{\partial f_i}{\partial x} + \frac{e}{M} \left(E + \frac{1}{c} [vH] \right) \frac{\partial f_i}{\partial v} = 0;$$

$$\text{div } E = 4\pi e \int (f_i - f_e) dv, \quad \text{rot } H = \frac{4\pi e}{c} \int v (f_i - f_e) dv,$$

$$E = -\nabla\Phi, \quad H = \text{rot } A.$$

Card 2/10

24705

S/056/61/040/005/005/019
B102/B201

Kinetic consideration of some...

If $H_x = 0$ one obtains

$$\frac{d^2 \Phi}{dx^2} = -4\pi e \int (f_i(v, A, \Phi) - f_e(v, A, \Phi)) dv. \quad (5)$$

$$\frac{d^2 A}{dx^2} = -\frac{4\pi e}{c} \int v (f_i(v, A, \Phi) - f_e(v, A, \Phi)) dv.$$

or, in axial symmetry ($H_r = 0$)

$$\begin{aligned} \frac{1}{r} \frac{d}{dr} r \frac{d\Phi}{dr} &= -4\pi e \int (f_i - f_e) dv, \\ \frac{d}{dr} \frac{1}{r} \frac{d}{dr} r A_s &= -\frac{4\pi e}{c} \int v_s (f_i - f_e) dv, \\ \frac{1}{r} \frac{d}{dr} r \frac{dA_s}{dr} &= -\frac{4\pi e}{c} \int v_s (f_i - f_e) dv. \end{aligned} \quad (11) \quad \checkmark$$

results. The solutions of (5) or (11) are obtained in considerably simpler way by taking the plasma to be quasineutral. The present study begins with

Card 3/10

24705

S/O56/61/040/005/005/019
B102/B201

Kinetic consideration of some...

by introducing dimensionless parameters (this holds for $x < 0$). For $Mc^2/T \gg 1$ and $\alpha \ll 1$ one obtains

$$\xi = \ln \left| \operatorname{tg} \frac{\chi}{4} / \operatorname{tg} \frac{\pi}{8} \right| + 2 \left(\cos \frac{\chi}{2} - \cos \frac{\pi}{4} \right), \quad \sin \chi = a. \quad (20)$$

which fits the result by Ferraro (J. Geophys. Res., 57, 15, 1952). The present study is then extended to a plasma screw (Fig. 3), in which the charge is compensated by cold neutrons. This system is described by

equations $d^2 a / d\xi^2 = a / \sqrt{1-a^2}$; $\gamma = -\frac{1}{2} \ln(1-a^2)$ with the integral

$\dot{a}^2 = h_1^2 + 2(1 - \sqrt{1-a^2})$, where $h_1 = H_1 e D_{1c} / Mc v_{01}$, H_1 being the field strength for $x = 0$. X

$$\xi = -4k^{-2} [E(k) - E(k, \pi/2 - \chi)] + 2(1 + 2/k^2) [K(k) - F(k, \pi/2 - \chi)]. \quad (22)$$

Card 5/10

24705
S/056/61/040/005/005/019
B102/B201

Kinetic consideration of some...

is obtained here for the field change. Finally, the authors examine the interface between plasma and field for ions with a Maxwellian distribution in $x = -\infty$, where the charge is, in turn, compensated by cold electrons.

$$\xi = \sqrt{\frac{2}{\pi}} \int_0^{\xi} dx \left[1 - \frac{4}{\pi} \int_0^{\infty} \exp(-x^2(1 + \xi^2)^2/4) d\xi^2 / (1 + \xi^2)^2 \right]^{-1/2}. \quad (29)$$

is obtained here. The motion in an axially symmetric field is studied in the following section. A plasma column of monochromatic ions and cold electrons (with Maxwellian distribution) is here considered first ($H_z \neq 0$, all other quantities depend on r only). For $v_{iz} = 0$ the ion trajectories of this system are as shown in Fig. 6a or 6b, depending on whether the Larmor radius is larger or smaller than the column radius. Instead of (11) one has

$$\frac{d}{dr} \left(\frac{1}{r} \frac{d}{dr} r A_0 \right) = - \frac{4\pi Q}{cr} \left(\frac{P}{Mr} - \frac{eA_0}{Mc} \right) \left[v_0^2 - \left(\frac{P}{Mr} - \frac{eA_0}{Mc} \right)^2 \right]^{-1/2}. \quad (32)$$

Card 6/10

2h705

S/056/61/040/005/005/019
B102/B201

Kinetic consideration of some...

where Q denotes the radial particle flux, and P is the generalized momentum:
 $Q = \text{env}_r = \text{const}$; $P = r(Mv_{\phi} + eA_{\phi}/c) = \text{const}$. In dimensionless parameters
($a = eA_{\phi}/Mc v_0$, $p = P/Mv_0$) one obtains

$$\frac{d}{dr} \left(\frac{1}{r} \frac{dra}{dr} \right) = - \frac{4\pi e Q}{Mc^2 v_0} \frac{p/r - a}{r \sqrt{1 - (p/r - a)^2}}. \quad (35)$$

and, with $N = \int n^2 r dr$

$$N = \frac{2\pi Q}{c v_0} \int_{r_1}^{r_2} \frac{dr}{\sqrt{1 - (p/r - a)^2}}. \quad (36)$$

In zeroth approximation $Q = e^2 H_0 N / 2\pi^2 Mc$, and

$$H = H_0 \left\{ 1 - \frac{2e^4 N}{\pi Mc^2} \arccos \frac{r_1 r_2 / r + r}{r_1 + r_2} \right\}, \quad r_1 \leq r \leq r_2. \quad (38)$$

Card 7/10

Kinetic consideration of some...

24705
S/056/61/040/005/005/019
B102/B201

For a nonrelativistic plasma ($c^2/v_{oe}^2 \gg 1$), $\psi = (1-\mu\theta)a^2/(1+\theta)$ is found, and further,

$$d^2a_1/d\xi_1^2 = a_1/\sqrt{1-a_1^2}, \quad (48)$$

$$a_1 = a [(1+\mu)\theta/(1+\theta)]^{1/2}, \quad \xi_1 = \xi [1+\sqrt{\mu\theta}]^{1/2}. \quad (49)$$

The thickness of the transition layer is thus found to be

$\delta \sim (mc/4\pi e^2 n_0) [1 + \sqrt{\mu\theta}]^{1/2}$. There are 8 figures and 6 references: 4 Soviet-bloc and 2 non-Soviet-bloc. The reference to the English-language publication reads as follows: L. Tonks. Phys. Rev. 118, 2, 1960.

SUBMITTED: August 3, 1960

Card 9/10

25852

S/020/61/139/004/012/025
B104/B209

24.4100

AUTHORS: Burshteyn, E. L., and Solov'yev, L. S.

TITLE: The Hamiltonian of an averaged motion

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 139, no. 4, 1961, 855-856

TEXT: In solving many physical problems one may use a method of approximation in which averaging of the respective equations and their representation in canonical form leads to their first integral. This study is concerned with a method of obtaining averaged canonical equations. The first section deals with averaging of differential equations of the form

$$\frac{dx_h}{dt} = \varepsilon f_h(x_i, t) \quad (1)$$

with a small parameter ε , which are periodic functions of t . These systems may be replaced by

$$\frac{dx_h}{dt} = \varepsilon \varphi_{1h}(\xi_i) + \varepsilon^2 \varphi_{2h}(\xi_i) + \dots \quad (2).$$

Card 1/6

25852

S/020/61/139/004/012/025

B104/B209

The Hamiltonian of an averaged ...

where $f_k = f_k(\xi_1, t)$ and η_{1k} are periodic functions of the argument t . The mean value of these functions with respect to t (with constant ξ_1) is defined as $\bar{f} = \int \tilde{f} dt$, where $\tilde{f} = f - \bar{f}$. In the system quoted last, the functions $\bar{\eta}_{1k}$ remain undetermined. The unique definition of η_{1k} and $\bar{\eta}_{1k}$ necessitates the introduction of additional conditions. The simplest of these is the postulate that the η_{1k} vanish. The second section deals with averaging canonical Hamiltonians, with

$$\frac{dq_k}{dt} = \frac{\partial H}{\partial p_k} \approx e/p_k, \quad \frac{dp_k}{dt} = -\frac{\partial H}{\partial q_k} \approx e/p_k, \quad (6)$$

taken as a starting point. When η_{1k} is properly chosen, (2) may assume the Hamiltonian form. For the determination of $\bar{\eta}_{1k}$, the canonical transformation

Card 3/6

25852

S/020/61/139/004/012/025

3104/3209

The Hamiltonian of an averaged ...

$q_1 = \frac{\partial}{\partial q_1} F(q_j, P_j, t, \epsilon)$, $Q_1 = \frac{\partial}{\partial P_1} F(q_j, P_j, t, \epsilon)$ is applied to (5).

The generating function is represented in the form of an expansion

$F = q_1 P_1 + \epsilon F_1(q_j, P_j, t) + \epsilon^2 F_2(q_j, P_j, t) + \dots$. The expressions for η_{1qk} and η_{1pk} defined by (3) are then determined by successive approximation:

$P_k = Q_k + \epsilon \eta_{1qk} + \dots$, $P_k = P_k + \epsilon \eta_{1pk} + \dots$. The relations

$$\begin{aligned} \eta_{1qh} &= -\frac{\partial F_1}{\partial P_h}, \quad \eta_{1ph} = \frac{\partial F_1}{\partial Q_h}, \\ \eta_{2qh} &= -\frac{\partial F_2}{\partial P_h} + \frac{\partial^2 F_1}{\partial P_h \partial Q_i} \frac{\partial F_1}{\partial P_i}, \quad \eta_{2ph} = \frac{\partial F_2}{\partial Q_h} - \frac{\partial^2 F_1}{\partial Q_h \partial Q_i} \frac{\partial F_1}{\partial P_i}. \end{aligned} \quad (7)$$

hold, where $F_k = F_k(Q_1, P_1, t)$. The expression

Card 4/6

The Hamiltonian of an averaged ...

S/020/61/139/004/012/025
B104/B209

$$\bar{\eta}_{1qh} = \bar{\eta}_{1ph} = 0, \quad \bar{\eta}_{2qh} = \frac{\partial f_{qh}}{\partial q_1} f_{q1}, \quad \bar{\eta}_{2ph} = \frac{\partial f_{ph}}{\partial q_1} f_{q1}. \quad (8)$$

is obtained under the assumption that the F_k are periodic functions of time, so that $\bar{F}_k = 0$. In order to establish symmetry, $\bar{\eta}_{1qk}$ and $\bar{\eta}_{1pk}$ are chosen in the form

$$\bar{\eta}_{1qh} = \bar{\eta}_{1ph} = 0, \quad \bar{\eta}_{2qh} = \frac{1}{2} \overline{f_1 \frac{\partial f_{qh}}{\partial t_1}}, \quad \bar{\eta}_{2ph} = \frac{1}{2} \overline{f_1 \frac{\partial f_{ph}}{\partial t_1}}. \quad (8').$$

Thus, Eq. (6) in conformance with (5) and (8'), may be obtained from approximative equations in the canonical form with "averaged" Hamiltonian at an accuracy of up to terms of the order of ϵ^2 :

Card 5/6

S/020/61/139/004/012/025
B104/B209

The Hamiltonian of an averaged

$$\mathcal{H} = \bar{H} + \frac{e}{2} \frac{\partial \bar{H}}{\partial \xi_i} \bar{f}_i + \frac{e^2}{2} \left(\frac{\partial^2 \bar{H}}{\partial \xi_i \partial \xi_j} \bar{f}_i \bar{f}_j + \frac{\partial \bar{H}}{\partial \xi_i} \frac{\partial \bar{f}_j}{\partial \xi_i} \bar{f}_j \right) \quad (9).$$

Application of these averaged equations to the motion of charged particles in quickly variable electromagnetic fields is not restricted to nonrelativistic cases only: however, the explicit form is very complex. The Hamiltonian averaged over one coordinate is discussed in the third section of this paper. It is assumed that the Hamiltonian to be averaged in the sense of the first two sections of the paper) is periodic with respect to one coordinate (which need not necessarily be Cartesian). The last section deals with an application of the above calculations to the averaging of magnetic surfaces. There are 5 Soviet-bloc references.

PRESENTED: December 15, 1960, by A. L. Mints, Academician

SUBMITTED: December 6, 1960

Card 6/6

24.302
S/057/62/032/007/012/013
B1Q4/B102

AUTHORS: Zuyeva, N. M., Morozov, A. I., and Solov'yev, L. S.

TITLE: Existence of magnetic surfaces of a periodic magnetic field having large longitudinal components, accurate to terms of the 4th order

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 7, 1962, 897-899

TEXT: Magnetic surfaces are shown to exist, in fourth approximation, in the general case of a periodic field which has large longitudinal component $H_{||}$. Magnetic surfaces not found by numerical methods either occur in higher approximation, or their effects are exponentially small. The equations averaged according to N. N. Bogolyubov for the lines of force of a magnetic field have unique integrals when terms of the order $(H_{\perp}/H_{||})^4$ are taken into account. JB

SUBMITTED: March 5, 1962

Card 1/1

SOLOV'YEV, L.S.

Stability of a cylindrical plasma stream in a magnetic field.
Dokl. AN SSSR 147 no.5:1071-1074 D '62. (MIRA 16:2)

1. Predstavleno akademikom M.A. Leontovichem.
(Plasma (Ionized gases)) (Magnetic fields)

MOROZOV, A.I.; SOLOV'YEV, L.S.

Geometry of the magnetic field. Vop. teor. plaz. no.2:3-91 '63.

Motion of charged particles in electromagnetic fields. Ibid.:177-261
(MIRA 17:2)

ACCESSION NR: AT4019714

S/3041/63/000/003/0245/0289

AUTHOR: Solov'yev, L. S.

TITLE: Symmetrical magnetohydrodynamic flows and helical waves in a round plasma cylinder

SOURCE: Voprosy* teorii plazmy*, no 3, 1963, 245-289

TOPIC TAGS: plasma, plasma cylinder, cylindrical plasma jet, magnetohydrodynamic flow, axial symmetry, translational symmetry, helical symmetry, helical flow, helical wave, linear wave

ABSTRACT: The general flow of a compressible liquid having helical symmetry is considered. Although the expressions can be derived in terms of only two spatial variables, the usual cylindrical coordinates are employed in the analysis here, since the transformation to the new coordinates is not complicated. The equations for the axial and translational symmetry are obtained from the helical symmetry by

Card 1/2

ACCESSION NR: AT4019714

going to the limit as the pitch of the helix goes to zero and to infinity, respectively. The section headings are: Introduction.
1. Stationary helical flows. 2. Helical waves. 3. On the stability of a cylindrical plasma jet in a magnetic field. 4. Nonlinear long-wave axially-symmetrical oscillations of a plasma cylinder. 5. Nonlinear helical waves. 6. Linear waves in a compressible plasma jet. Appendix. Curvature and torsion of the coordinate line x_3 in the case when $\partial g_{ik} / \partial x_3 = 0$. Literature. Orig. art. has: 173 formulas and 6 figures.

ASSOCIATION: Institut elektroniki, avtomatiki i telemekhaniki AN GruzSSR (Institute of Electronics, Automation, and Telemechanics, AN GruzSSR)

SUBMITTED: 00

DATE ACQ: 12Mar64

ENCL: 00

SUB CODE: PH

NR REF SOV: 016

OTHER: 009

Card 2/2

DEM'YANENKO, D.M.; KOROZA, V.I.; RODA, A.A.; SOLOV'YEV, L.S.

Applicability of analog computers for calculating electron
trajectories in linear accelerators. Uskoriteli no.5:91-95
'63. (MIRA 17:4)

MOROZOV, A.I.; SOLOV'YEV, L.S.

Typical structure of a toroidal magnetic field. Zhur. eksp. i
teor. fiz. 45 no.4:955-959 0 '63. (MIRA 16:11)

S/020/63/149/003/008/028
B112/B180

AUTHORS: Morozov, A. I., Solov'yev, L. S.

TITLE: Symmetric magnetohydrodynamic flows

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 149, no. 3, 1963, 550 - 553

TEXT: For the stream functions ψ_0, ψ, I_0, I which are defined by

$$\begin{aligned} r \begin{pmatrix} v_r \\ H_r \end{pmatrix} &= \begin{pmatrix} \frac{1}{\rho} \frac{\partial \psi_0}{\partial \theta} \\ \frac{\partial \psi}{\partial \theta} \end{pmatrix}, \quad ar \begin{pmatrix} v_z \\ H_z \end{pmatrix} - \begin{pmatrix} v_\phi \\ H_\phi \end{pmatrix} = \begin{pmatrix} \frac{1}{\rho} \frac{\partial \psi_0}{\partial r} \\ \frac{\partial \psi}{\partial r} \end{pmatrix}, \\ r \begin{pmatrix} l_r \\ l_r \end{pmatrix} &= \begin{pmatrix} \frac{\partial I_0}{\partial \theta} \\ \frac{\partial I}{\partial \theta} \end{pmatrix}, \quad ar \begin{pmatrix} l_z \\ l_z \end{pmatrix} - \begin{pmatrix} l_\phi \\ l_\phi \end{pmatrix} = \begin{pmatrix} \frac{\partial I_0}{\partial r} \\ \frac{\partial I}{\partial r} \end{pmatrix}, \end{aligned} \quad (6)$$

the system of equations

Card 1/3

Symmetric magnetohydrodynamic flows

S/020/63/149/003/008/028
B112/B180

$$\frac{s}{p} \Delta^* \xi + \frac{1}{2\beta p} \frac{\partial s}{\partial \xi} (\nabla \xi)^2 - \frac{\psi_0'^2}{\beta p^2} (\nabla p \nabla \xi) + \frac{1}{2\beta p} \frac{\partial A^2}{\partial \xi} s + \frac{\beta}{2} \frac{\partial B^2}{\partial \xi} s + \frac{\partial}{\partial \xi} \frac{AB\psi_0'}{ps\psi} - \frac{2\alpha A}{\beta p} - U' = 0; \quad (10)$$

$$W + \frac{v^2}{2} + \Phi + \frac{\beta B^2}{s} + \frac{AB\psi_0'}{ps\psi} = U, \quad s \equiv \frac{\psi_0'}{p} - \psi'^2; \quad (11)$$

$$r \left(\frac{v_r}{H_r} \right) - \left(\frac{\psi_0'}{\psi} \right) \frac{\partial \xi}{\partial \theta}, \quad ar \left(\frac{v_s}{H_s} \right) - \left(\frac{v_\theta}{H_\theta} \right) = \left(\frac{\psi_0'}{\psi} \right) \frac{\partial \xi}{\partial r}, \quad (12)$$

$$\left(\frac{v_s}{H_s} \right) + ar \left(\frac{v_\theta}{H_\theta} \right) = \frac{A}{s} \left(\frac{\psi_0'}{\psi} \right) + \frac{\beta B}{s} \left(\frac{\psi}{\psi_0'} \right),$$

where $\Delta^* = \frac{1}{r} \frac{\partial}{\partial r} r \frac{\partial}{\partial r} + \frac{1}{r^2} \frac{\partial^2}{\partial \theta^2}$, is derived. The equations (10) - (12) describe the stationary flow of an ideal conductive compressible fluid in a magnetic field with helical symmetry. A and B are arbitrary functions of ξ . Examples of plane and axially symmetric flows are considered.

PRESENTED: October 27, 1962, by M. A. Leontovich, Academician
Card 2/3

Symmetric magnetohydrodynamic flows

S/020/63/149/003/008/028
B112/B180

SUBMITTED: October 11, 1962

Card 3/3

SOLOV'YEV, L.S.

Hydromagnetic stability of a rotating plasma. Dokl. AN SSSR
153 no.5:1048-1051 D '63. (MIRA 17:1)

1. Predstavleno akademikom M.A. Leontovichem.

L 41497-65 EMT(1)/EMP(m)/EPA(sp)-2/ENG(v)/MPR/EPA(w)-2/T-2/ETA(m)-2 Feb-10/
 ACCESSION NR: AP5000269 Pd-1/Pe-5/Ps-4/Pl-4 IJP(c) 5/0040/64/028/006/0987/0995

AUTHORS: Aleksyeva, L. M. (Moscow); Solov'yev, L. S. (Moscow)

TITLE: Current eddies and critical surfaces in magnetohydrodynamic flow

SOURCE: Prikladnaya matematika i mekhanika, v. 28, no. 6, 1964, 987-995

TOPIC TAGS: MHD flow, ideal fluid, plasma flow, steady flow equation, propagating wave, sonic line, stability criterion, magnetic pressure

ABSTRACT: The steady-state axisymmetric flow of an ideal conducting plasma across an azimuthal magnetic field H is studied analytically. The purpose is to investigate singular points on the family of current curves $rH_\phi = \text{const}$ and to calculate the form of the critical curve where v becomes equal to the propagation speed $|c_r| = \sqrt{c_r^2 + H_\phi^2/4\pi\rho}$. The flow velocity is assumed to have two components v_r and v_z and, physically, the problem corresponds to the flow between two electrodes (see Fig. 1 on the Enclosure). It is assumed that the magnetic pressure is small compared to the gas pressure $\beta \equiv 8\pi\rho H^{-2} \gg 1$, and that the flow changes slowly along the z -axis. The governing equations then become $\frac{\partial}{\partial r} \left(\frac{1}{\rho r} \frac{\partial \xi}{\partial r} \right) = 0$, $W(\rho) + \frac{1}{2} \left(\frac{1}{\rho r} \frac{\partial \xi}{\partial r} \right)^2 = U$ and $I/\rho r^2 = B(\xi)$, ($I \equiv rH_\phi/\sqrt{4\pi}$). Taking the r and z derivatives of the current curve

L 41497-65
ACCESSION NR: AP5000269

$I(r, z) = \text{const}$, it is shown that the singular points of this family of curves lie on the curve OO' (see Fig. 1). Taking the second derivatives of I , it is found that if the singular point on OO' lies below $r_c = 0.92R$, $V_c = 0.22u$, the curve is of the elliptic type, whereas if above these points the curve is hyperbolic. Furthermore, assuming $U = \text{const}$ and the parameter $B(\xi)$ variable, the governing equations are written for both weak and strong magnetic fields $\frac{\partial}{\partial r} \frac{1}{\rho r} \frac{\partial \xi}{\partial r} + \frac{\partial}{\partial z} \frac{1}{\rho r} \frac{\partial \xi}{\partial z} + \frac{\rho r^2}{2} \frac{dB^2}{d\xi} = 0$.

$W(\rho) + \frac{v^2}{2} + \rho r^2 B^2 = U$ and to a first approximation (order ϵ , $V_{12} = 0$, $b = \text{const}$) the sonic surface is found to be planar, or $V^2(z) = 1/3 u^2$. Correcting these results to order V , the curves of Fig. 2 are obtained (see Fig. 2 on the Enclosure) where OA corresponds to the negligible terms $(V^1)^2$ and OB shows the sonic curve for weak and strong fields where B^2 or W are neglected. The stability of the flow is investigated up to order ϵ . It is shown that for stability relative to axisymmetric perturbations the derivative of K^2/r^2 must be negative, and for helical stability, $(rH^2)'$ should be negative. "The authors are grateful to A. I. Morozov and K. V. Brushlinskiy for their valuable advice." Orig. art. has: 5 figures and 50 equations.

ASSOCIATION: none

Cord 2/4

Submitted: 25 MAR 64

ACCESSION NR: AP4020569

S/0057/64/034/003/0429/0443

AUTHOR: Morozov, A.I.; Solov'yov, L.S.

TITLE: Axially symmetric steady flow of a plasma in an azimuthal magnetic field

SOURCE: Zhurnal tekhnicheskoy fiziki, v.34, no.3, 1964, 429-443

TOPIC TAGS: plasma, plasma flow, plasma xxxxxx accelerator, adiabatic plasma flow, magnetohydrodynamics, steady magneto hydrodynamic flow

ABSTRACT: The steady isentropic flow in the annular space between two coaxial surfaces of revolution of a perfectly conducting compressible fluid in the presence of an azimuthal magnetic field is discussed in some detail. The calculations were undertaken because of possible applications to plasma acceleration. The magnetohydrodynamic equations are specialized to the case of isentropic flow with axial symmetry in which the radial and longitudinal components of the magnetic field and the azimuthal component of the velocity vanish. The resulting equations are discussed in two limiting cases: 1) the width of the annular channel is small compared with its radius, although both the width and the radius may be functions of the longitudinal coordinate z ; 2) all quantities are slowly varying functions of z . In case 1)

Card 1/2

ACCESSION NR: AP4020569

it is possible to solve the problem for arbitrary channel shape. The solutions in which either the hydrodynamic or the magnetic pressure is small compared with the other are discussed in more detail. It is found that under some conditions the current may reverse and the magnetic field may act locally to decelerate the fluid. In case 2) the simplified equations are still nonlinear. Their solution is formulated as a Cauchy problem: one boundary of the channel is specified, together with the flow rate along it, and the other boundary is obtained as part of the solution. A number of solutions are obtained for the two limiting cases of a cold plasma, and of "isomagnetic flow" (the magnetic field proportional to the product of the fluid density and the distance from the axis). The shape of the "critical surface" on which the flow velocity is equal to the velocity of magneto-acoustic waves is discussed. Orig.art.has: 94 formulas and 5 figures.

ASSOCIATION: none

SUBMITTED: 01Mar63

DATE ACQ: 31Mar64

ENCL: 00

DJB DODE: PH

NR REF SOV: 004

OTHER: 001

Card 2/2

S/0067/64/034/007/1141/1153

ACCESSION NR: AP4041988

AUTHOR: Morozov, A. I.; Solov'yev, L. S.

TITLE: Plane flow of a perfectly conducting compressible fluid with the Hall effect taken into account

SOURCE: Zhurnal tekhnicheskoy fiziki, v.34, no.7, 1964, 1141-1153

TOPIC TAGS: plasma, magnetohydrodynamics, Hall effect, plane parallel stream, steady flow

ABSTRACT: The magnetohydrodynamics equations for the steady flow of a perfectly conducting plasma are modified to take account of the Hall effect, and some consequences of the modified equations are derived. The modification of the magnetohydrodynamic equations consists in replacing the usual equation, $\text{rot}[\mathbf{v}, \mathbf{H}] = 0$ by

$$\mathbf{E} + \frac{1}{c}[\mathbf{v}, \mathbf{H}] - \frac{1}{enc}[\mathbf{j}, \mathbf{H}] = 0,$$

and introducing the equation

$$\mathbf{v}_* = \mathbf{v} - \frac{1}{en},$$

Card 1/2

ACCESSION NR: AP4041988

for the current j . Here v_0 is the electron velocity and v is the ion velocity. In the remaining magnetohydrodynamic equations the velocity is assumed to be that of the ions; thus, the electron pressure and the inertial forces of the electrons are neglected. Two stream functions are introduced (one for the ions and one for the electrons), and the conservation laws are derived. The plane flow in a channel bounded by cylindrical walls of arbitrary shape is discussed in some detail, and solutions are obtained for a narrow channel and for a channel with slowly varying section. The walls of the channel are regarded as electrodes through which current enters and leaves the plasma; the flow is thus of the type that occurs in a magnetohydrodynamic accelerator or pump. In such a system the Hall emf at the wall of the channel is tangent to the wall; the conductive wall will thus short circuit the Hall emf and a peculiar Hall-effect boundary layer will develop. This boundary layer is not discussed in detail. It is assumed that the boundary layer can be avoided by employing slotted electrodes. Orig.art.has: 98 formulas and 4 figures.

ASSOCIATION: none

SUBMITTED: 25Jun63

ATD PRESS: 3082

ENCL: 00

SUB CODE: ME,EM

NR REF SOV: 002

OTHER:000

Card 2/2

L 8638-c: ENI(l)/ENP(m)/ENG(k)/EPA(sp)-2/ENG(v)/EPR/EPA(w)-2/EEC(t)/T-2/
EEC(b)-2/EWA(m)-2 Pz-6/Po-4/Pd-4/Pab-24/Pe-5/Ps-4/Pi-4 IJP(c)/RAEM(a)/
BSD/AEDC(a)/ESD(gs)/RAEM(c)/AFWL/SSD/ASD(a)-5/AFETR/ASD(d)/ASD(f)-2/AEDC(b)/
ASD(p)-3/ESD(t) WW/AT

ACCESSION NR: AP4041989

8/0057/64/04/007/1154/1169

AUTHOR: Morozov, A. I.; Solov'yev, L. S.

TITLE: Acceleration of a rotating plasma in axially symmetric channels

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 34, no. 7, 1964, 1154-1169

TOPIC TAGS: plasma, magnetohydrodynamics, plasma acceleration, plasma rotation

ABSTRACT: In this paper, earlier theoretical work of the authors (DAN SSSR, 149, 3, 1963; ZhTF 34, 3, 429, 1964) concerning the magnetohydrodynamic acceleration of a perfectly conducting plasma in an axially symmetric channel of annular cross section is extended to include rotation of a plasma and the presence of a longitudinal magnetic field. The magnetohydrodynamic equations are taken from the earlier work in a form suitable for axially symmetric calculations, and their integrals are discussed. The flow in narrow axially symmetric channels is then discussed. The flow in narrow axially symmetric channels is then discussed in detail. After the general integrals and the appropriate form of the Hugoniot equation are derived, flow with infinitely small initial velocity is discussed separately for the two cases that the radius of plasma (of infinitesimal but variable

Card 1/2

L 8638-65
ACCESSION NR: AP4041989

section) is or is not constant. The velocity of flow cannot pass continuously through the local signal velocity; the three possible types of continuous flow (flow velocity always greater than, equal to, or less than the local signal velocity) are discussed separately. In the final section the authors treat the flow of a cold plasma in a channel which need not be narrow, but in which the radii of the walls are slowly varying functions of the axial coordinate. Orig. art. has: 98 formulas and 6 figures.

ASSOCIATION: none

SUBMITTED: 18Jul63

ENCL: 00

SUB CODE: ME, EM.

NO REF SOV: 005

OTHER: 000

Card 2/2

1. 15052-65 EWT(d)/EWT(1)/EWG(k)/EPA(sp)-2/EEC-4/EPA(w)-2/EEC(t)/T/EEC(b)-2/
EED-2/EWA(m)-2/EWP(1) Pg-4/Pi-4/Pk-4/Pc-4/Pq-4/Pz-6/Pab-10 IJP(c)/AFWL/S3D(b)/
ASD(a)-5/AEDC(b)/SSD/BSA/ASD(p)-3/AFETR/RAEM(a)/ESD(g)-2/ESD(t) 00/AT/BB
ACCESSION NR: AP4045265 5/0057/64/034/009/1566/1575

AUTHOR: Morozov, A. I.; Solov'yev, L. S.

TITLE: Cybernetic control of plasma instabilities 21

SOURCE: Zhurnal tekhnicheskoy fiziki, v.34, no.9, 1964, 1566-1575

TOPIC TAGS: plasma instability, plasma stability, cybernetic system

ABSTRACT: It is proposed to suppress the development of certain instabilities in a plasma by injecting currents or applying local corrective magnetic fields of strengths and at locations determined by the developing instability itself. The proposal is illustrated by a discussion of the flute instability of a plasma cylinder confined in a magnetic field between magnetic mirrors. A number of probes would be disposed azimuthally about the plasma cylinder. Should an excrescence begin to develop, the nearest probe would sense this and the signal from this probe would cause application of an additional magnetic field at the appropriate position, thereby increasing the local magnetic pressure and driving the excrescence back into the body of the plasma. Alternatively, the signal from the probe could cause an azimuthal current to be injected into the plasma through electrodes on either side of the ex-

L 15062-65

ACCESSION NR: AP4045265

5

orescence. It is estimated that for a 2 m long 60 cm diameter deuterium plasma cylinder in a 10^4 Oe magnetic field, having a particle density of 10^{12} cm $^{-3}$ and thermal velocities of 10^8 cm/sec, corrective currents of the order of 30 A or corrective magnetic fields of the order of 50 Oe would be required. The nature of the feedback required to achieve stability is discussed in some detail for the simply Taylor instability of a plasma layer in magnetic and gravitational fields and for several instabilities of plasma cylinders, including constrictions, the helical instability in the presence of a longitudinal current, and the flute instability of a rotating filament. It is concluded that stability can be achieved in all these cases, but that the feedback signal must provide information concerning not only the present magnitude of the developing instability, but also concerning its rate of growth.

"The authors express their gratitude to Academicians L.A.Artsimovich and M.A.Leontovich for their interest in the present work, and also to M.S.Ioffe, Ye.I.Dobrokhotov and N.N.Semashko for valuable discussions." Orig.art.has: 56 formulas and 7 figures.

ASSOCIATION: none

SUBMITTED: 13Nov63

SUB CODE: ME

NR REF SOV: 005

ENCL: 00

OTHER:001

2/2

L 27901-65 ENT(1)/EPA(sp)-2/ENT(m)/EMA(d)/ENG(v)/T-2/EPA(w)-2/EPR/EMA(m)-2
 Pd-1/Pab-10/Pa-5/Pa-4/P1-1 IJP(c)

ACCESSION NR: AP4012080

S/0020/64/154/002/0306/0309

67

AUTHOR: Morozov, A. I.; Solov'yev, L. S.

B

TITLE: Symmetric flows of conducting fluid across a magnetic field

SOURCE: AN SSSR. Doklady*, v. 154, no. 2, 1964, 306-309

TOPIC TAGS: magnetic hydrodynamics, conducting fluid, compressed fluid, fluid flow, fluid mechanics, magnetohydrodynamics, axially symmetric fluid flow, magnetic field

ABSTRACT: A two-dimensional and axially-symmetric flow of a compressed conductive fluid was examined. Authors assumed for simplicity that fluid is nonviscous and non-heat conducting. Then the stationary flow is described by the following magnetohydrodynamic equations:

- (1) $\rho (\nabla \nabla) \mathbf{v} = - \nabla p + [\mathbf{j} \mathbf{H}]$,
- (2) $\text{div } \rho \mathbf{v} = 0, \quad \text{div } \mathbf{H} = 0$,
- (3) $\text{rot } \mathbf{E} = 0, \quad \rho T \nabla \nabla S = \mathbf{v} \mathbf{j}^2$.

Card 1/3

L 27901-65

ACCESSION NR: AP4012080

where $\vec{E} \equiv \frac{c}{V4\pi} \mathbf{E} = \mathbf{v}_m \mathbf{j} - [\mathbf{vH}] = \nabla\Phi, \mathbf{j} \equiv \text{rot } \mathbf{H}, \mathbf{v}_m = c^2/4\pi\sigma,$
 ρ = density; p = pressure; κ = conductivity; T = temperature; S = entropy; \mathbf{V} = velocity;
 $\mathbf{B} = \sqrt{4\pi} \mathbf{H}$; \mathbf{H} = magnetic field; \mathbf{E} = electrical field. The following system of equations
 was then derived for the examined axially-symmetric flow:

$$\text{div } \mathbf{q} = 0, \quad \mathbf{q} = \rho \mathbf{v} \left(W + \frac{v^2}{2} \right) + [\mathbf{eH}], \quad (4)$$

$$dW = \frac{dp}{\rho} + T dS. \quad (5)$$

$$\left(\frac{\rho v_z}{l_z} \right) = \frac{1}{r} \frac{\partial}{\partial r} \left(\frac{\Psi}{l} \right), \quad \left(\frac{\rho v_r}{l_r} \right) = -\frac{1}{r} \frac{\partial}{\partial z} \left(\frac{\Psi}{l} \right). \quad (6)$$

$$\frac{1}{\rho r} \frac{\partial}{\partial r} \frac{1}{\rho r} \frac{\partial \Psi}{\partial r} + \frac{1}{\rho r} \frac{\partial}{\partial z} \frac{1}{\rho r} \frac{\partial \Psi}{\partial z} + l \Phi'(\Psi) + T \frac{\nabla S \nabla \Psi}{\rho^2 r^2 c^2} - U'(\Psi) = 0, \quad (7a)$$

$$W + \frac{v^2}{2} + l \Phi'(\Psi) = U(\Psi), \quad (7b)$$

$$\frac{l}{\rho r^2} - v_m \frac{\nabla l}{\rho r^2 c^2} = \Phi'(\Psi), \quad (7b)$$

$$\rho T v \nabla S = \frac{v_m}{r^2} (\nabla l)^2. \quad (7r)$$

Card 2/3

L 27901-65

ACCESSION NR: AP4012080

Two-dimensional flows in a narrow channel are described by the system:

$$\rho v f = \alpha = \text{const}, \quad (8)$$

$$\frac{H}{\rho} - \frac{v_m}{\rho v} \frac{dH}{ds} = \beta = \text{const}, \quad (9)$$

$$\Psi + \frac{v^2}{2} + \beta H = U = \text{const}, \quad (10)$$

$$\rho v T \frac{dS}{ds} = v_m \left(\frac{dH}{ds} \right)^2. \quad (11)$$

Orig. art. has: 30 equations.

ASSOCIATION: None

SUBMITTED: 23Jul63

ENCL: 00

SUB CODE: ME, EM

NO REF SOV: 003

OTHER: 000

Card 3/3

L 12916-65 EWT(1)/EWG(k)/EPA(sp)-2/EPA(w)-2/EEC(t)/T/EEC(b)-2/EWA(m)-2 Pz-6/Po-4/
Pab-10/Pl-4 IJP(c)/AEDC(b)/AFWL/AFETR/ASD(a)-5/ASD(p)-3/SSD/RAEM(a)/ESD(gs)/ESD(t)/
ACCESSION NR: AP4047322 SSD(b) AT S/0020/64/158/004/0831/0834

AUTHORS: Morozov, A. I.; Solov'yev, L. S. B

TITLE: Equilibrium of plasma pinch with helical perturbations

SOURCE: AN SSSR. Doklady*, v. 158, no. 4, 1964, 831-834

TOPIC TAGS: plasma pinch, plasma instability, plasma containment

ABSTRACT: It is shown that the appearance of singularities in the linearized equations for perturbations of toroidal plasma configurations is connected with a qualitative rearrangement of the structure of the magnetic surfaces, and that arbitrarily small static perturbations can lead to finite changes in plasma configurations and thus noticeably affect their stability. The configurations considered are: 1. Cylindrical magnetic surfaces with helical perturbations. 2. Equilibrium helical plasma configurations. 3. Force-free plasma configuration. The first case results in a wavy mag-

Card 1/2

L 12916-65

ACCESSION NR: AP4047322

netic-surface structure with the elliptic and hyperbolic singular points lying on circles. In the second case it is shown that, depending on the choice of the initial equilibrium configuration, the development of instability reduces to the formation of a stable filamentary plasma structure. In the case of a force-free plasma configuration it becomes possible to obtain the stability conditions for a plasma supported by an ideally conducting liner. This report was presented by M. A. Leontovich. Orig. art. has: 6 formulas and 1 figure.

ASSOCIATION: None

SUBMITTED: 14Apr64

ENCL: 00

SUB CODE: ME

NR REF SOV: 007

OTHER: 001

Card 2/2

L 13954-66 EWT(1)/ETC(P)/EPF(n)-2/ENG(m) IJP(s) DM/AT

ACC NR: AP6001691

SOURCE CODE: UR/0089/65/019/005/0420/0423

AUTHOR: Morozov, A. I.; Solov'yev, L. S.

ORG: none

TITLE: Magnetic mirror trap with a field increasing in all directions

SOURCE: Atomnaya energiya, v. 19, no. 5, 1965, 420-423

TOPIC TAGS: magnetic mirror machine, magnetic trap, axial magnetic field

ABSTRACT: The authors investigate the topography of the stationary point of the square of a magnetic field. It is shown that only saddle points of B^2 may exist along the axis of an axisymmetric field; minima of B^2 cannot be found in a plane field; a minimum of B^2 cannot be found in an axisymmetric field in a point which is not on the axis if the field direction in that point coincides with the symmetry axis z . Consequently, axisymmetric traps with minimum field region can be designed by using an azimuthal field as a basis (e.g., in conjunction with a superposed quadrupole field) or a basic radial field such as proposed by J. Andreoletti (C. r. Acad. sci., Paris, 256, 1969, (1963)). Since such a field has a very simple configuration, the authors study the properties of such Andreoletti fields the field strength lines of which become concentrated when approaching the z axis. Several possible solutions are proposed for magnetic mirror traps with special pole pieces or appropriate surface currents. Orig. art. has: 26 formulas and 3 figures. UDC: 533.9

Card 1/1 PC SUB CODE: 20/ SUBM DATE: 28Jan65/ ORIG REF: 002/ OTH REF: 003

L 3376-66 EWT(1)/ETC/EPF(n)-2/ENG(n)/EPA(w)-2 IJP(c) AT
 UR/0020/65/164/001/0080/0083
 ACCESSION NR: AP5023363

AUTHORS: Morozov, A. I.; Solov'yev, L. S.

TITLE: A similarity parameter in theory of plasma flows

SOURCE: AN SSSR. Doklady, v. 164, no. 1, 1965, 80-83

TOPIC TAGS: similarity analysis, plasma flow, compressible flow, magnetic field, entropy, Hall effect

ABSTRACT: A similarity analysis is made of a two-fluid, fully ionized plasma flow under steady state conditions. A vector potential is defined for ions and electrons

$$n_e v_e = \text{rot } \vec{\Psi}_e, \quad n_i v_i = \text{rot } \vec{\Psi}_i$$

which, when combined with Maxwell's equation, yields

$$\Pi = \frac{4\pi e}{c} (\vec{\Psi}_i - \vec{\Psi}_e) + \Pi_0$$

The similarity parameter for the flow is defined by

$$\xi = \frac{c |\Pi - \Pi_0| \text{ charact}}{4\pi |\vec{\Psi}_i| \text{ charact}}$$

Card 1/2

L 3376-66

ACCESSION NR: AP5023363

For the case of a flow in a coaxial channel of arbitrary cross section ξ becomes

$$\xi = \left| \frac{N_s - N_i}{N_i} \right| = \frac{I_p}{I_n}.$$

Because of the fact that ψ is a three-dimensional vector, one can construct three ξ parameters. In the absence of dissipation terms and for $m_e/M \rightarrow 0$, the magnetic field degenerates into an electron component where one can show that ξ takes on the physical meaning of a "charge exchange" parameter. Orig. art. has: 16 equations and 3 figures.

ASSOCIATION: none

SUBMITTED: 05Jan65

NO REF SOV: 003

ENCL: 00

OTHER: 001

SUB CODE: ME

Card 2/2 *1-1*

L 33012-66 EWT(1) LJP(c)

SOURCE CODE: UR/0020/66/168/001/1176/0079

ACC NR: AP6015087

60
B

AUTHOR: Solov'yev, L. S.

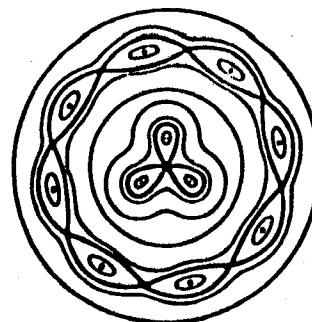
ORG: None

TITLE: Stability of magnetic surfaces

SOURCE: AN SSSR, Doklady, v. 168, no. 1, 1966, 76-79

TOPIC TAGS: magnetic property, surface property, coordinate system, structure stability, magnetic field

ABSTRACT: An approximate integral is found for equations of the lines of force of a magnetic field with a large longitudinal component in an arbitrary curvilinear coordinate system. The accuracy of the approximation depends on the selection of the curvilinear coordinates for the longitudinal and transverse components of the magnetic surfaces with respect to weak disturbances in the magnetic field. A right section showing the typical structure of stable magnetic surfaces is given in the figure. Orig. art. has: 1 figure, 13 formulas.



SUB CODE: 20/ SUEN DATE: 29Jul65/ ORIG REF: 005/ OTH REF: 002

UDC: 533.9

Cord 1/1 *plw*

L 06977-67

ACC NR: AP6018349

separatrix are smaller than the distance to the magnetic axis. The feasibility of realizing such a magnetic configuration is thus connected with the three-dimensional nature of the magnetic axis and with the ellipticity of the normal sections of the magnetic surfaces. Orig. art. has: 8 figures and 47 formulas.

SUB CODE: 20/

SUBM DATE: 14Aug65/

ORIG REF: 002/

OTH REF: 001

Card 2/2 *llh*

77(1) 147(c) AT
ACC No. 10001049

SOURCE CODE: BR/0020/66/276/001/0075/0078

AUTHOR: Solov'yev, L. S.; Shafraanov, V. D.

ORG: none

TITLE: Contribution to the theory of equilibrium of a plasma in a toroidal magnetic trap

SOURCE: AN SSSR. Doklady, v. 170, no. 1, 1966, 75-78

TOPIC TAGS: magnetic trap, plasma stability, thermodynamic equilibrium, plasma magnetic field, perturbation theory

ABSTRACT: The purpose of the study was to ascertain the applicability of the boundary conditions (the Kruskal and Kulsrud conditions and the Newcomb condition) to the magnetic differential equation of a toroidal equilibrium plasma configuration. Solution of the differential equation for the toroidal magnetic surfaces in the linear approximation shows that the presence of resonant harmonics can either destroy the magnetic surfaces completely, or else under certain conditions lead only to a splitting of the resonant magnetic surfaces into a filamentary structure. Near resonance, only one harmonic of the perturbing field affects the stability of the surface. A method for solving the problem of plasma equilibrium in toroidal magnetic traps, based on the determination of the currents in the plasma and the associated disturbances of

Card 1/2

UPC: 533.9

L 09318-67

ACC NR: AP6031645

the magnetic surfaces, is outlined. It is concluded that the formal solution of the perturbation-theory problem of equilibrium toroidal magnetic configurations contains small denominators analogous to the solutions of perturbation-theory equations in classical mechanics. The difficulties connected with the presence of the small denominators can be circumvented by normalizing (suitably choosing) the unperturbed solution on which the source function of the perturbation-theory equation depends. A concrete method of renormalization is proposed. This report was presented by Academician M. A. Leontovich 8 December 1965. Orig. art. has: 21 formulas.

SUB CODE: 20/ SUBM DATE: 29Oct65/ ORIG REF: 005/ OTH REF: 005

Card 2/2

ACCESSION NR: AR4032171

S/0058/64/000/002/D029/D029

SOURCE: Ref. zh. Fiz., Abs. 2D223

AUTHORS: Reznikov, V. M.; Pilipchuk, Yu. S.; Solov'yev, L. S.

TITLE: Infrared spectra of dioxane-lignin

CITED SOURCE: Sb. Materialy* 1-y Nauchn. konferentsii Kompleksn. problemn. labor. Sibirsk. tekhnol. in-t. Krasnoyarsk, 1961, 36-42

TOPIC TAGS: dioxane, lignin, dioxane lignin, infrared spectrum, absorption spectrum, hydrogen bond, hydroxyl group

TRANSLATION: Infrared dioxane-lignin absorption spectra (3619--763 cm^{-1} region) were investigated in KBr dissolved in dioxane, suspended in mineral oil, and in the form of a film. A strong hydrogen bond is observed in the dioxane-lignin. It is established that in the lignin molecule, part of the hydroxyl groups remains free. It

Card 1/2

ACCESSION NR: AR4032171

is noted that the dioxane and the lignin are bound quite strongly
in the film.

DATE ACQ: 31Mar64

SUB CODE: PH, CH

• ENCL: 00

Card 2/2

L 42871-66 ENT(1)/ENT(m)/ENT(s)/T 13P(c) 10/EN
ACC NR: ARG017234 SOURCE CODE: UR/0058/65/000/012/D033/D033

AUTHOR: Korshunov, A. V.; Solov' yev, L. S.

60
B

ORG: none

2/

TITLE: Infrared absorption spectra of paradihalogen-substituted benzene in various states of aggregation

SOURCE: Ref. zh. Fizika, Abs. 12D270

REF SOURCE: Tr. Komis. po spektroskopii. AN SSSR, t. 3. vyp. 1, 1964, 588-594

TOPIC TAGS: IR spectrum, absorption spectrum, benzene, liquid nitrogen, single crystal growth, halogen

ABSTRACT: The infrared absorption spectra have been obtained for paradihalogen-substituted benzene in various states of aggregation and at the temperature of liquid nitrogen. The method of growing fine single crystals has been worked out. Polariza-

Card 1/2

L 42871-66

ACC NR: AR6017234

tion analysis has been carried out for the infrared absorption spectrum of oriented single crystals of the paradihalogen-substituted benzene. Interpretation of bands has been carried out. It has been shown that the fission of certain bands conforms to theory. A. Davydov. [Translation of abstract] (NT)

SUB CODE: 0720/ ~~SUBM DATE: none/~~ ~~ORIG REF: none/~~ ~~SOV REF: none/~~
~~OTH REF: none/~~

Card 2/2

L 16714-65 EWT(m)/EPF(c)/EWP(j) Pc-4/Pr-4 ESD(t)/ESD(c)/ESD(gs)/SSD/AFWL/
 ASD(a)-5/AFMD(t)/AFETR/RAEM(a) RM S/0058/64/000/010/D025/D025
 ACCESSION NR: AR5000775

SOURCE: Ref. zh. Fizika, Abs. 10D192

AUTHORS: Korshunov, A. V.; Solov'yev, L. S.; Shufledovich, V. I.; Nekoshnova, N. S.

TITLE: Infrared absorption spectra of certain substances with hydrogen bonds in different aggregate states

CITED SOURCE: Tr. Sibirsk. tekhnol. in-ta, sb. 36, 1963, 10-17

TOPIC TAGS: Ir absorption spectrum, hydrogen bond, band spectrum, polarization

TRANSLATION: Infrared absorption spectra of phenol, resorcin, guaiacol, and naphthol in different aggregate states and at a temperature of liquid nitrogen are obtained. The polarization of the bands of the substances in the solid state was also investigated. It is found that in the liquid and particularly in the crystalline state the investigated substances have a few additional bands which are less intense than the fundamental bands

Card 1/2

L 16715-65

ACCESSION NR: AR5000773

was found to be 5.65×10^3 neutrons/mole-roentgen.

SUB CODE: NP

ENCL: 00

Card 2/2

L 1300-66 EWT(m)/EPF(c)/EWP(j)/T RM

ACCESSION NR: AR5014391

UR/0058/65/000/004/E928/D028

SOURCE: Ref. zh. Fizika, Abs. 4D209

AUTHOR: Shufledovich, V. I.; Solov'yev, L. S.; Kuz'mina, Z. M.; Nekoshnova, N. S.;
Sarapkin, P. S.; Korshunov, A. V.; Finkel'shteyn, A. F.

TITLE: Some spectral characteristics of the side chains in furane compounds

CITED SOURCE: Sb. Spektroskopiya. M., Nauka, 1964, 118-120

TOPIC TAGS: spectrographic analysis, Raman spectrum, IR spectrum, furane resin, aldehyde, conjugate bond system, alkyl radical

TRANSLATION: The authors studied the effect of the furane ring on the position of the stretching vibration bands of CH_3 , C=O and C=C groups in the Raman and IR spectra of 6 furane derivatives. The frequencies of the fundamental bands in the spectra of these compounds are given in the $4050\text{-}216\text{ cm}^{-1}$ range. The position of symmetric and skew-symmetric stretching vibration bands in CH_3 groups in the spectra of furfurylidene acetone, sylvan and 1-(α -furyl)-butanone-3 is practically the same as the ordinary position of the bands for this group. The position of stretching

Card 1/2

L 1300-66

ACCESSION NR: AR5014391

vibration bands for C=O ($1660-1685\text{ cm}^{-1}$ in the spectra of the two latter compounds) indicates that conjugation of this bond with the furane ring results in the same effects as conjugation with one double bond. / Yu. Kissin.

SUB CODE: OC, OP

ENCL: 00

mlr
Card 2/2

1. V. I. V.

1. V. I. V. -- "Therapeutic Properties of Streptococcus Antitoxin."
Izv. Vsesoyuzn. Akad. Med. Nauk. (Dissertation for the Degree of Candidate
in Medical Sciences).

2. Yezhennaya Krov'ya January-December 1972

SOLOV'YEV, L. Ya.

[Tax on services rendered; a practical manual] Nalog s netoverykh
operatsii; prakticheskoe posobie. Moskva, Gosfinizdat, 1949. 31p.
(Taxation) (MLRA 9:2)

35912
S/181/62/004/006/018/051
B125/B104

24.2600

26.2420

AUTHORS: Lider, K. F., and Solov'yev, L. Ye.

TITLE: The optical and photoelectrical properties of GeS and GeS₂

PERIODICAL: Fizika tverdogo tela, v. 4, no. 6, 1962, 1500-1502

TEXT: The authors studied the absorption spectra of GeS and GeS₂ single crystals and layers, and the spectral distribution of photoconductivity of a GeS crystal. The edge of the GeS₂ spectrum (just as that of MoO₃, BiO₃, V₂O₅, As₂S₃, PbO, HgI₂) has no structure; a photoconductive effect does not show up. A narrow, intense, polarized absorption line each was observed in the absorption spectrum of GeS at 77°K and at 4°K. The GeS and GeS₂ specimens (monocrystalline plates) were synthesized from Ge and S in a quartz ampoule and then annealed at a temperature near their melting point. The two absorption edges of the GeS crystals at room temperature are at ~7670 Å and 7260 Å. When the crystal is cooled to 77°K, the edges pass on to 7240 Å and 6900 Å. The long-wave edge

Card 1/3

S/121/62/004/006/018/051
3125/3104

The optical and...

corresponds to the polarization E_{aa} , the short-wave edge to E_{cc} . a and c are the crystal axes lying in the plate plane. The absorption line $\sim 7185 \text{ \AA}$, observed in thin plates ($d \sim 50 \text{ \AA}$) and when the crystal was turned about the axis parallel to a , corresponds to a plane oscillator in the plane perpendicular to the c axis. At $T = 4.2^\circ\text{K}$, the edge in the component E_{aa} is at $\sim 7140 \text{ \AA}$ and the line is at $\sim 7110 \text{ \AA}$. A broad luminescence band at $\sim 8000 \text{ \AA}$ appears in GeS crystals at 77°K . The blurred edge of the spectra of the GeS crystals is displaced from 3500 \AA at room temperature to 3300 \AA at 77°K . The curve of the spectral distribution of photoconductivity taken in unpolarized light at 77.3°K has a maximum at $\sim 7200 \text{ \AA}$. The spectrum taken at 300°K is more intense, with a peak at $\sim 7000 \text{ \AA}$. The resistivity of GeS_2 specimens did not change on irradiation with concentrated undecomposed light from a mercury vapor lamp. Owing to the partial decomposition of the vacuum evaporation-coated GeS_2 layers (with formation of GeS), absorption occurs in the range of transparency of the GeS_2 crystals. The spectrum of a GeS_2 layer vapor-plated in an H_2S atmosphere is similar to the absorption spectrum of the GeS_2 crystals.

Card 2/3

The optical and...

S/181/62/004/006/016/051
B125/B104

The absorption edge may lie between 7200 Å and 3400 Å, according to the shares of GeS_2 and GeS in the mixture. There are 2 figures.

ASSOCIATION: Leningradskiy gosudarstvennyy universitet (Leningrad State University)

SUBMITTED: January 12, 1962

Card 3/3

S/020/62/146/003/009/019
B101/B144

AUTHORS: Gross, Ye. F., Corresponding Member AS USSR, Chang Kuang-yin, Solov'yev, L. Ye.

TITLE: Absorption spectrum in the light-blue and dark-blue spectral ranges and deformation effects in thin specimens of cuprous oxide

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 146, no. 3, 1962, 577-580

TEXT: Absorption and reflection spectra of Cu_2O specimens were taken at 4.2 and 77.3°K to check the assumption (Ref. 1: Fiz. tverd. tela, 4, 261, 827 (1962)) that the observed splitting of spectral lines of the Cu_2O single crystal is caused by deformation effects. In the absorption spectrum of a specimen 1 μ thick, the intense light-blue lines $\lambda_1^{(1b)'} = 4817 \text{ \AA}$, $\lambda_1^{(1b)''} = 4777 \text{ \AA}$, and the weak lines $\lambda_2^{(1b)'} = 4740 \text{ \AA}$ and $\lambda_2^{(1b)''} = 4724 \text{ \AA}$ were observed, which are interpreted as a splitting of

Card 1/43

S/020/62/146/003/009/019
B101/B144

Absorption spectrum in the ...

the lines $\lambda_1^{(lb)} = 4796 \text{ \AA}$ and $\lambda_2^{(lb)} = 4733 \text{ \AA}$ observed in the reflection spectrum. This was confirmed by the reflection spectrum of a wedge-shaped Cu_2O specimen, where the splitting increased with decreasing wedge thickness, whereas no splitting was observed for a Cu_2O lamina of 10-15 μ thickness. Likewise, the dark-blue lines $\lambda_1^{(db)} = 4569 \text{ \AA}$ and $\lambda_2^{(db)} = 4505 \text{ \AA}$ were split in the wedge-shaped specimen. With a 5 μ thick Cu_2O specimen, these lines were split into two perpendicularly polarized lines. As $\lambda_1^{(lb)}$ and $\lambda_1^{(db)}$ are more intense than $\lambda_2^{(lb)}$ and $\lambda_2^{(db)}$ it is concluded that they are allowed lines of hydrogen-like exciton series: light-blue series $\lambda_n^{(lb)} = 21220 - 368/n^2 \text{ cm}^{-1}$, $n = 1, 2, \dots$; dark-blue series $\lambda_n^{(db)} = 22302 - 415/n^2 \text{ cm}^{-1}$, $n = 1, 2, \dots$. A band diagram is suggested (Fig. 4) which, complementary to Ref. 1, is confirmed by new experimental data: Between 4.2 and 77.3°C, the differences between the temperature coefficients of the yellow and green series are equal to those between the light-blue and dark-blue series.

Card 2/43

Absorption spectrum in the ...

S/020/62/146/003/009/019
B101/B144

If the dielectric constants of all series are set equal to each other, then $(R^{(db)} - R^{(lb)}) / (R^{(g)} - R^{(y)}) = R^{(db)} R^{(lb)} / R^{(g)} R^{(y)}$ holds for the experimental values of the Rydberg constants $R^{(y)} = 780.7$, $R^{(g)} = 1200$, $R^{(lb)} = 368$, $R^{(db)} = 415 \text{ cm}^{-1}$. In all four exciton series, the deformation effect acts primarily on the conductivity band. Under the action of stress the conductivity sub-band Γ_6^+ is slightly shifted, and the Γ_{12}^- sub-band is split. There are 4 figures. The most important English-language references are: J. B. Grun, M. Sieskind, S. Nikitine, J. Phys. Chem. Solids, 21, 119 (1961); R. J. Elliott, Phys. Rev., 108, 1384 (1957); 124, 340 (1961).

SUBMITTED: June 18, 1962

Card 3/43

L 58916-65 EWT(m)/EPA(w)-2/EWA(m)-2 Pt-7 IJP(c) OS

ACCESSION NR: AT5007936

S/0000/64/000/000/0471/0474

AUTHOR: Belov, A. D.; Mur'in, B. P.; Solov'yev, L. Yu.; Kapchinskiy, I. M. ³⁰⁹₈₊₁

TITLE: Automatic regulation and measurement of the parameters of the high-frequency fields in a linear 100-Mev accelerator-injector ¹⁹

SOURCE: International Conference on High Energy Accelerators. Dubna, 1963. Trudy. Moscow, Atomizdat, 1964, 471-474

TOPIC TAGS: linear accelerator, high energy accelerator

ABSTRACT: In a linear 100-Mev proton accelerator-injector, the amplitude and phase of the high-frequency oscillations must be stabilized with an accuracy respectively ± 2 and $\pm 3^\circ$, according to the tolerances (I. M. Kapchinskiy et al., present conference, p. 462). In an accelerator one applies a system for the automatic regulation of the phase of the accelerating high-frequency voltage and the characteristic frequency of the resonator. The accepted measures for stabilizing the feed voltages in the generators permit a considerable decrease in the variation of the phase in the high-frequency accelerator channels. It is possible here to apply only electronic-mechanical automatic regulation systems, which eliminates slow phase departures in the high-frequency feed track and the thermal disorganization of the reso-

Card 1/3

L 58916-65

ACCESSION NR: AT5007936

nator (B. P. Murin, NT-2160, Radiotekhnicheskiy institut AN SSSR. M. 1960). The present report discusses the general scheme of the high-frequency track and the electric circuit of the automatic phase regulation system in the accelerator channels. Selection of the carrier phases yields, for a given accuracy of the automatic phase regulation system, optimum stability of the fixed difference of phases among the resonators. The present report discusses the expanded block diagram of the automatic phase regulation system for the second channel. In the bridge-type phase transducer, a signal from the resonator is in phase with the high-frequency carrier phase oscillations. In case of the presence of a phase error, a pulse signal will appear at the output of the phase transducer. The information entering the regulation system is free of transitional processes, since the phase transducer has a stroboscope circuit which permits limiting the information during the course of the last 30 microseconds after establishment of the high-frequency field in the resonator. In the circuit for processing the error signal, the information is held up to the following track, and after arrival of the second error signal of the same sign from preceding tracks the circuit transforms it into a controlling voltage, which acts upon the electric motors through magnetic amplifiers. Each resonator has two plates for correcting the distribution of the accelerating field along the resonator axis. The report discusses the main parameters of the automatic phase

Card 2/3

L 58916-65

ACCESSION NR: AT5007936

regulation system and the principal system errors and their propagation and a system of automatic control for the fixed phase relations among the resonators. Amplitude transducers are employed for controlling the amplitude of the high-frequency field. The transducers are connected with loops in the resonators with the aid of a coaxial 75-ohm cable, in which a traveling-wave state has been established. The transducer transforms the high-frequency pulse into a video pulse, whose amplitude is measured by a compensation method with manual setting of the carrier voltage. Accuracy of measurement is 0.5%. Aperture of the first drift tube is 20 mm. The transverse acceptance of the linear accelerator has been computed to be about 0.8 cm-millirad for full aperture. The accelerator will deliver about 100 milliamperes. Pulse length will vary from 12 microseconds for one-revolution injection up to 40 microseconds for three. The repetition rate is 12 pulses per minute. Orig. art. has: 4 figures.

ASSOCIATION: Radiotekhnicheskiy institut AN SSSR (Radio Engineering Institute, AN SSSR)

SUBMITTED: 26May64

ENCL: 00

SUB CODE: EE, NP

NO REF SOV: 002

OTHER: 000

Card 3/3 *dm*

SOLOV'EV, N. [Solov'yov, N.]

Initial trailers for the transport of containers. Transp delo
6 No.9/10:89 '54.

L 21442-66 ENT(d) BC
ACC NR: AP6003293 SOURCE CODE: UR/0209/66/000/001/0064/0065

AUTHOR: Solov'yev, M. (Engineer)

ORG: none

TITLE: How to check out base-altitude indicators

SOURCE: Aviatsiya kosmonavtika, no. 1, 1966, 64-65

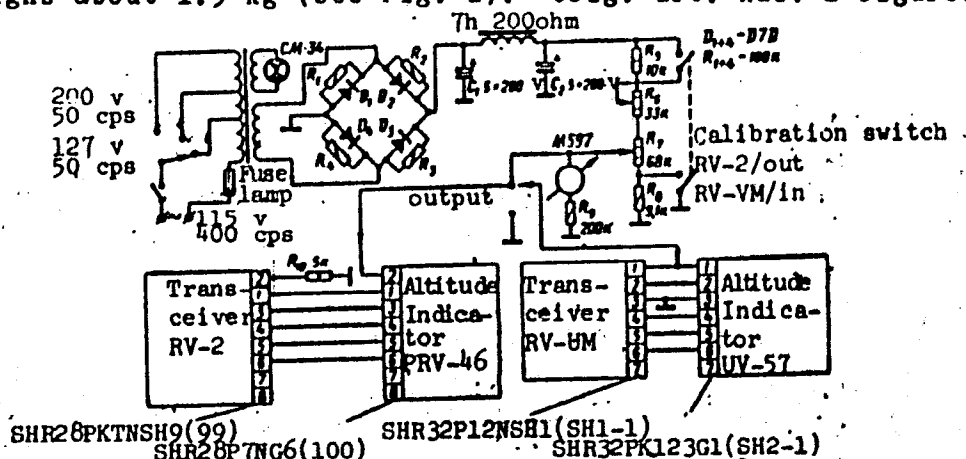
TOPIC TAGS: altimeter, aircraft flight instrument, instrument calibration equipment

ABSTRACT: A portable instrument for checking low-altitude radio altimeters having light and audio base-altitude indicators is proposed. With this instrument the altitude indicators can be adjusted directly in the aircraft or in the laboratory. The instrument works on 115-v,

Card 1/2

L 1442-66
ACC NR, AP6003293

400-cps or 127/220-v, 50-cps current. With adapters and cable the device weighs about 1.5 kg (see Fig. 1). Orig. art. has: 1 figure.



Crossover for cali-
bration of SV-R RV-2

Crossover for cali-
bration of RV-UM

Fig. 1. Device for checking and calibrating altitude indicators

[WS]

SUB CODE: 01/ SUBM DATE: none/ ATD PRESS: 4221
Card 2/2

OLEV-YEV, N., inventor.

Adopt more extensively the new methods for producing buckwheat groats.
Muk.-olev.prom. 23 no.7:21-22 of '57. (MIRA 10:9)
(Buckwheat) (Grain milling)

SOLOV'YEV, M., inzh.

Machine for polishing hulled millet. Mukh.-elev. prom. 24 no.4:
18 Ap '58. (MIRA 11:5)

1. Glavnoye upravleniye mukomol'noy, krupyanyy i kombikormovoy
promyshlennosti Ministerstva khleboproduktov SSSR.
(Grain milling machinery)

SOLOV'YEV, M. . inzh.

Production of five grades of polished corn groats. Muk. elev. prom.
24 no.11:23-24 N '58. (MIRA 11:12)

1.Glavnoye upravleniye mukomol'noy, krupyanoy i kombikormovoy
promyshlennosti Ministerstva khleboproduktov RSFSR.
(Corn milling)

SOLOV'YEV, M.

Machine for polishing groats. Muk.-elev.prom. 26 no.1:30-31 Ja
'60. (MIRA 13:6)
(Grain-milling machinery)

NEZLOBIN, M.; KHABE, L.; SOLOV'YEV, M.

Recent developments in the technology of groats. Muk.-elev.
prom. 29 no.9:20-22 S '63. (MIRA 17:1)

1. Proizvodstvenno-tekhnicheskoye upravleniye Gosudarstvennogo komiteta zagotovok (for Nezlobin, Khabe).
2. Vserossiyskoye ob'yedineniye khleboproduktov (for Solov'yev).